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The effects of Phorate (*Thimet*) used in nematode control of some biochemical components of seeds of treated soybean *Glycine max* (L.) Merrill

E. E. A. Oyedunmade

Department of Crop Production, University of Ilorin, Ilorin, Nigeria.

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ABSTRACT: The effects of a synthetic nematicide Phorate (O,O-diethyl thiomethyl phosphoro dithioate) on some biochemical components of the seeds of treated soyabean cultivars TGM 80 and TGM 344 were studied. Results show that treated plants had significantly (P = 0.05) higher crude fibre, crude protein, fat/oil and phosphorus contents but lower free fatty acids than the control. The values of free fatty acids which were obtained for plants treated with 1500 and 1000 µg a.i/ml were less than half of those obtained for the controls in both soyabean cultivars TGM 80 and TGM 344. This shows that Phorate can be used successfully to control root knot nematodes on soyabean and consequently to enhance the quality of treated soyabean seeds.

Key Words: Nematode control; Nematicide; Phorate; Soyabean.

Introduction

Soyabean has a wide range of utilization and nutritional values in Nigeria (Ogundipe and Oshe, 1990; Ogundipe and Weingnartner, 1992) and in several countries of the world (Ferrier, 1975). It has a great potential not only as a whole bean but as a vegetable source of proteins, oils, vitamins and minerals (taylor, 1980). It is a cheap source of protein in the human diet in many developing countries and in the livestock feed industry worldwide. However, soyabean is attacked by a large number of pest-pathogen combinations which serve as a threat to its profitable production.

Phorate (O, O-diethyl thiomethyl phosporo dithioate) has been reported to control a number of nematode pests of agricultural importance and improve growth and yield of treated crops without the fear of harmful residues in such crops (Oyedunmade and Adesiyan, 1990, 1994; Oyedunmade *et al*., 1992) but information on the possible effects of this chemical nematicide on the biochemical components of treated crops is lacking.

This study was therefore undertaken to investigate the effects of Phorate on the crude fibre, crude protein, fat/oil, free fatty acid and phosphorus contents of soyabean seeds harvested from the plants that were treated with Phorate against root knot nematode attack.

Materials and Methods

Seeds of two soyabean cultivars, Hernon 236 (TGM 344) and Bosier (TGM 80) were obtained from the International Institute for Tropical Agriculture (IITA) and planted separately on 2 adjacent plots of land heavily infested with root knot nematode *Meloidogyne incognita* during the planting seasons of two consecutive years. Two weeks after planting, Phorate solutions containing 500, 1,000 and 1,500 µg a.i/ml were used as soil drench against the nematodes, while distilled water was used for the control. The design of the experiment was a complete randomised block of 4 treatments with 4 replicates each.

At maturity, soyabean seeds were harvested from the differently treated plants and analysed for possible effects of Phorate treatments on their crude protein, fat/oil, crude fibre, free fatty acid and phosphorus contents. The percentage crude protein content, fat/oil, free fatty acids and crude fibre were determined by the methods of A.O.A.C. (1975) while the phosphorus content was determined by the method described by Watanabe and Oisen (1965). The data for the two years were pooled together, averaged and subjected to analysis of variance, and where appropriate, the means were separated by Duncan's Multiple Range Test.

Results and Discussion

The results show that Phorate treatments improved the food quality of seeds of soyabean plants in the 2 cultivars tested. The free fatty acid content of Phorate treated soyabean plants was significantly lower than that of the control plant (Table 1). In both cultivars of soyabean tested, the free fatty acid contents of plants treated with the two higher doses of Phorate (100 and 150 µg a.i/ml) were lower than half of the free fatty acid content of the control. On the other hand, the seeds from treated plants had significantly higher fat/oil content than those from the control plants. The observed reduction in the fat/oil contents with resultant increase in the free fatty acid content observed for the soyabean seeds from untreated plants may indicate that part of the fat/oil had been degraded into free fatty acids. Increase in free fatty acid contents of plant materials is a useful measure of deterioration which nematodes and other pests/pathogens are capable of causing in attacked plants (Yang *et al*., 1976).

Table 1: Effects of Phorate treatment on percentage fat/oil and free fatty acid contents of two yoyabean cultivars (TGM 80 and TGM 344).

Phorate Levels (µg a.i/ml)	**Mean**	**Fat (%)**	**Mean**	**Free Fatty Acids (%)**
	TGM 80	**TGM 344**	**TGM 80**	**TGM 344**
1,500	20.54a	20.13a	0.49a	0.36a
1,000	19.96a	19.17a	0.56a	0.53ab
500	18.90a	19.44a	0.87a	0.80b
0 (Control)	14.01b	15.25b	1.50b	1.41c

Means in the same column followed by different letters are statistically different at P = 0.05.

The crude fibre and protein contents of seeds from treated soyabean plants were significantly increased as a result of the Phorate treatment as compared with the control (Table 2). However, in soyabean cultivar TGM 344, the crude fibre content of seeds at the lowest dosage level of 500 µug a.i/ml Phorate treatment was not significantly different from that of the control. The observed increase in the crude fibre and protein contents of Phorate treated seeds is an indication of an increase in the net assimilation rate and consequently total yield quality of the soyabean plants. On the other hand, root knot nematode infected plants usually have poorer net assimilation as a result of root damage (resulting in reduced water and mineral salt absorption from the soil) reduction in size and number of leaves, early senescence and stunting.

Oyedunmade and Adesiyan(1990, 1994) have reported better vegetative growth and yield in soyabean plants treated with Phorate as a result of nematostatic and nematotoxic effects of the chemical on the nematodes.

The reduction in the phosphorus content of untreated seeds when compared with that of treated seeds (Table 2) might have resulted from an impairment of phosphorus and other nutrient uptake from the soil by the plant as a result of the root-knot nematodes infection leading to galled/damaged roots, thus making phosphorus content of infected plants lower than that of healthy plants. A control of these nematodes by Phorate possibly enhanced phosphorus uptake and translocation. Another possible source of the increase in the phosphorus content of treated plants is from the Phorate itself because it is a phosphorus rich chemical which is capable of breaking down to many other metabolites in the soil and plants (Bowman *et al*., 1969; Oyedunmade and Adesiyan, 1994). More phosphorus could have been released as a result of the breakdown of the Phorate molecule and this will subsequently affect the phosphorus content of the plants as more phosphorus becomes available in the immediate environment of the plant.

Table 2: Effects of Phorate treatment on percentage crude fibre, crude protein and phosphorus of two soyabean cultivars (TGM 80 and TGM 344).

Phorate level µg a.i/ml	**Mean crude**	**Fibre (%)**	**Mean Crude**	**Protein (%)**	**Mean**	**Phosphorus (%)**
	TGM 80	**TGM 344**	**TGM 80**	**TGM 344**	**TGM 80**	**TGM 344**
1,500	7.52a	8.55a	43.31a	44.69a	0.68a	0.69a
1,000	6.73a	7.97a	42.50a	42.91a	0.66a	0.67a
500	6.43a	5.68b	40.26a	41.44a	0.64a	0.65a
0 (Control)	4.17b	5.16b	36.97b	37.42b	0.50b	0.51b

Means in the same column followed by different letters are statistically different at P = 0.05.

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